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APPLICATION FOR UNITED STATES LETTERS PATENT

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TITLE: **PATIENT POSITIONING DEVICE FOR A COMPUTER TOMOGRAPH**

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PATIENT POSITIONING DEVICE FOR A COMPUTER TOMOGRAPH

TECHNICAL FIELD

[0001] This application relates to a patient positioning device for a computer tomograph device and, to a computer tomograph device having a patient positioning device of this kind.

BACKGROUND

[0002] Computer tomograph devices (CTs), serve to make three-dimensional images or images of slices of a body. The image data are computed by a computer using two-dimensional X-ray projections of the body. For recording the two-dimensional raw image data, an X-ray beam source and an image detector are disposed diametrically opposite one another and rotate about the body to be examined. The rotation takes place inside a gantry which has an examination opening, or aperture, into which the body can be introduced.

[0003] The position of the body in the gantry and the stability of the body position affect the CT image quality. A patient positioning device should therefore assure sufficiently stable support of the patient body and should not have any significant sagging, for instance, in response to the patient's weight. At the same time, however, a complicated construction for supporting the patient body in the examination opening of the gantry cannot be used, because it would create interfering artifacts in the image.

[0004] On the other hand, a patient positioning device should be adjustable flexibly enough that handling the patient when shifting the patient onto the patient positioning device and providing medical care of a patient already lying on it is made simpler. For example, it may be desirable for the patient positioning device to be able to be lowered so the patient can lie down on the patient positioning device or raised so the patient can get up from the patient positioning device.

[0005] Good accessibility for medical staff is advantageous, and for that reason the space below the patient positioning device should be as free possible and without intervening structures.

[0006] German patent disclosure DE 101 08 549, teaches a patient positioning device that enables flexible positioning and assures a stable position of the patient's body in the examination opening of the gantry of a CT device. However, the positioning device offers no possibility of height adjustment, and has a bulky construction below the patient, which makes accessibility more difficult.

[0007] A patient positioning device for a computer tomograph (CT) device and a CT device having such a patient positioning device are described. The patient positioning device ensures a stable position of the patient body in the examination opening of the gantry, is simultaneously flexibly adjustable in position, and has good accessibility to medical staff.

[0008] The patient positioning device for a computer tomograph device includes a gantry supported on a base; a bed guide for a patient bed; and has an arm which is supported in the vicinity of the head end and the foot end thereof by rotating joints that are rotatable about a horizontal axis that is disposed perpendicular to the length of the patient positioning device. The bed guide is supported on the arm by a joint that is rotatable about a horizontal axis and that is perpendicular to the length of the patient positioning device. The height of the bed guide is adjustable by movement of the arm about the rotating joints supporting the arm. When the bed guide is partly or completely lowered, the rotating joint is not located underneath the bed guide.

[0009] The bed guide is supported on an arm in the vicinity of its head end or foot end. When the bed guide is partly or completely lowered, a construction is obtained in which the space below the bed guide remains free.

[0010] This assures good accessibility to the patient. The term bed guide should be understood in this context to mean a structural element that makes it possible to attach a patient bed. The bed guide may have the capability of being solidly connected to a patient bed, or it may be a rail-like guide that allows the

patient bed to be placed on the bed guide or slidabley inserted therein for displacement in the longitudinal direction.

[0011] The motion of the patient bed that results from the rotatable mounting of the arm in the vicinity of its head end or foot end that the patient bed, simultaneously moves the bed away from a gantry and downward. Because of the greater distance of the patient bed from the gantry when in this position, the accessibility of the patient bed is improved and, furthermore, there is less interference with any operation of the gantry that may be taking place at the same time. Thus, a CT examination can, for instance, proceed unimpeded for a first patient, while another patient is being placed on another lowered patient bed.

[0012] While being raised, the bed guide is also simultaneously moved closer to the gantry, which is an improvement in terms of wear and tear on the patient bed and thus on the patient's body in the examination area. For instance, the leverage with which the patient weight is supported relative to the bed guide and which causes sagging of the patient bed is reduces.

[0013] In an aspect, the patient positioning device has a height adjuster, which is connected to the arm such that the height adjuster can rotate the arm about the rotating joint by which the arm is supported in the vicinity of the head end or foot end of the base. The height adjuster may have a motor for this purpose, which adjusts the arm, for instance, by means of a worm drive associated with the motor and a gear wheel on the arm. The motor may also drive a hydraulic drive that drives the arm around the rotating joint. The height adjuster permits an automatic adjustment of the height of the patient bed and thus makes the work of the medical staff easier.

[0014] In another aspect, the patient positioning device has a support arm, which is supported on the arm by a joint that is rotatable about a horizontal axis, and on which support arm the bed guide is supported by a joint that is rotatable about a horizontal axis. The length of the arm may be automatically adjustable such that the orientation of the bed guide remains stable, regardless of a rotation of the arm. This permits a patient to be placed, for instance, on a horizontally

oriented patient bed, and the orientation of the patient bed to be maintained when the height of the patient bed is adjusted.

[0015] Maintaining the orientation of the patient bed is pleasant for the patient who is being moved automatically by the patient positioning device, and enables positioning the patient, with the patient bed lowered, in exactly the position in which an ensuing CT examination is to be done. Changes in the patient position, as the patient positioning device is moved to approach the gantry, which could cause movements on the part of the patient and hence interfering artifacts in the CT image data, are thus averted.

[0016] The automatic adjustment of the length of the support arm can be implemented in a similar manner to the rotary motion of the arm. For instance, if the rotary motion is attained purely mechanically, such as by a worm drive and a gear wheel, then the adjustment of the length of the support arm can also be accomplished by means of a mechanical gear-wheel or lever system. If the rotary motion of the arm is driven hydraulically, then the length of the support arm can also be adjusted hydraulically.

[0017] Hydraulic adjustment enables flexible movement of both the arm and the support arm, so that the height of the patient bed is adjustable by the arm, and the orientation is adjustable by the support arm, freely and independently of one another. If the orientation of the bed guide is to be maintained while the arm is being adjusted, the longitudinal adjustment of the support arm may be adapted to the motion of the arm. The hydraulic drive can perform the longitudinal adjustment in accordance with a characteristic curve as a function of the adjustment of the arm. The characteristic curve depends on the geometric relationships among the arm, the support arm, and their rotating joints.

[0018] In a further aspect, a CT device has one patient positioning device on each side of the through-hole opening, or aperture, of the gantry. CT examinations of a plurality of patients may be performed smoothly and quickly.

[0019] That is, one patient can be placed on the lowered patient bed on one side of the gantry, and another patient located on the other patient positioning

device can be examined in the CT device contemporaneously. Once the examination is concluded, the patient bed is lowered and thus moved away from the gantry. This makes the examination opening available for the examination of the next patient, who is moved toward the examination opening by the motion of another patient positioning device. The patient bed of a further patient to be examined can then be introduced into the bed guide of the patient positioning device on the opposite side. The CT examination of that patient then begin while the patient positioning device on the second side is lowered again for receiving a further patient.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Exemplary embodiments of the invention will be described in further detail below in conjunction with the drawings. Shown are:

[0021] Fig. 1 is a perspective view of a CT device with a patient positioning device;

[0022] Fig. 2 is a side view of the CT device with the patient positioning device; and

[0023] Fig. 3 is a side view CT device with another example of the patient positioning device.

DETAILED DESCRIPTION

[0024] Exemplary embodiments may be better understood with reference to the drawings, but these examples are not intended to be of a limiting nature. Like numbered elements in the same or different drawings perform equivalent functions.

[0025] A CT device 1 with a patient positioning device is shown in a perspective view in Fig. 1. The CT device 1 has a gantry 3 with an examination opening. The gantry 3 rests on a base 5. A patient to be examined is placed on a patient bed 9, which is introduced into the bed guide 7. The bed guide 7 guides the patient bed 9 so that the patient bed is displaceable longitudinally, such that the patient bed 9 may be introduced into the examination opening or aperture in the

gantry 3. Gantry 3 may have a patient positioning device on each side of the examination opening, and the patient bed 9, on being introduced into the aperture in gantry 3, is transferred the bed guide 7' of the opposite patient positioning device disposed at the opposite side of the aperture.

[0026] The bed guide 7 is supported in the arm 11 via a rotating joint 19, rotatable about a horizontal axis. The arm 11 is supported in or on the base 5 by a rotating joint 17 such that the arm 11 is rotatable about a horizontal axis. The rotating joint 17 may be integrated with the base 5. Alternatively, the rotating joint 17 may be part of the patient positioning device, and be mounted in the vicinity of the base 5 but not as an integral part thereof. Thus, the patient positioning device can be a structural unit that is independent of the CT device 1 and that may be joined to it in modular fashion.

[0027] The height of the bed guide 7 is adjusted by rotating the arm 11 about the rotating joint 17. In the process, to maintain the bed 9 orientation, which in the drawing is horizontal, the bed guide 7 also rotates about the corresponding rotating joint 19.

[0028] The orientation of the bed guide 7 is stabilized by means of a support arm 13. The support arm 13 supports the bed guide such that sagging due to the patient's weight is reduced. To enable maintaining the orientation of the bed guide 7 while the height is being adjusted, the support arm 13 is supported in the arm 11 by a rotating joint 21 that is rotatable about a horizontal axis, and by a rotating joint 23 in the bed guide 7 that is rotatable about a horizontal axis. The length of the support arm 13 may be adjusted mechanically by a gear-wheel or lever system that is driven by a rotary motion of the arm 11. Alternatively, the support arm 13 length adjustment may be effected hydraulically and may be adapted to the motion of the arm 11 by means of a characteristic curve for controlling the hydraulic drive. The rotary motion of the arm 11 can be driven either mechanically, for instance by a motor-driven worm gear and a gear wheel on the arm, or by a hydraulic drive.

[0029] The patient positioning device may be configured such that the bed guide 7 automatically maintains a horizontal orientation, or such that the orientation of the bed guide 7 can be adjusted by the medical staff. Upon adjustment of the height by rotation of the arm 11, an orientation, once assumed, is automatically maintained by means of the mechanics or the hydraulics.

[0030] Another patient positioning device, located on an opposite side of the gantry 3, is illustrated by the bed guide 7', visible Fig. 1. The other components, which are not visible, correspond to those on a front side of the gantry 3. The gantry 3 may have a patient positioning device on either one side or on both sides.

[0031] Fig. 2 shows a side view of the CT device 1 with the patient positioning device disposed on each side of the gantry 3, A patient bed 9 introduced into the left-hand one of the two bed guides 7, 7'. The t second patient positioning device, also has an arm 11', with rotating joints 17', 19' that are rotatable about horizontal axes, and a support arm 13, with rotating joints 21', 23' that are rotatable about horizontal axes.

[0032] A height adjuster 15 serves to adjust the height of the bed guide 7 by means of a rotary motion of the arm 11 about the joint 17. The rotary motion of the arm 11 is by motor, mechanically, or hydraulically. The individual components of the height adjuster 15 are not shown in the drawing. Each of the two patient positioning devices has its own height adjuster 15, 15', so that the height of each of the two bed guides 7, 7' may be adjusted independently of one another.

[0033] In another aspect, Fig. 3 shows a side view of a CT device 1 with one patient positioning device on each of the two sides of the gantry 3. The patient positioning devices have the similar characteristics to the patient positioning devices shown in Fig. 2, with the exception of the support arms 13, 13'. Support arms 13, 13', are rotatably attached to the height adjusters 15, 15', and to the bed guides 7, 7' by rotatable hinges 23, 23' and cooperate with the base 5, 5, and the bed guides 7, 7' to create a parallelogram structure with the arms 11, 11'. Such an arrangement assures the horizontal orientation of the bed guides 7, 7' during a height adjustment process. The arms 11, 11' are supported as described above and

are driven by height adjusters 15, 15', the support arms 13, 13' are now located parallel to the arms 11, 11'. While one bearing point of the support arms 13, 13' is still located in bed guides 7, 7', the other bearing point is located in or on the base 5, to achieve a parallelogram arrangement.

[0034] The parallelogram arrangement mechanically maintains the orientation of the bed guides 7, 7' regardless of the motions of the arms 11, 11', To make a change in the orientation of the bed guides 7, 7', the support arms 13, 13', in this example, may be adjustable in length. The length adjustment can be effected mechanically or hydraulically.

[0035] Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of the invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the following claims.